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UNITED STATES PATENT APPLICATION

OF

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FOR

METHOD OF MEASURING AND SIZING OBJECTS FROM AN IMAGE OF A HUMAN FACE USING IRIS SIZE

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METHOD OF MEASURING AND SIZING OBJECTS FROM AN IMAGE OF A HUMAN FACE USING IRIS SIZE

1. Technical Field of the Invention

The present invention relates to a method for measuring and sizing objects depicted in a visual image, and more particularly for measuring and sizing a human face by visual imaging.

2. Background of the Invention

Historically, personal products such as eyewear, which must fit precisely on a user's face, and which need to have the lenses arranged at the proper interocular distance (i.e. the distance between the eyes), have had to be physically arranged on the actual user's face, in person, in order to ensure a proper fit. This requires the user to physically visit a specialist's office or physically visit a merchant, which is time-consuming, and also limits the selection of frames or other accessories to those which the specialist or the merchant can immediately obtain. These same problems apply to other personal products, such as wigs, rings, clothing items, et cetera.

3. Disclosure of the Invention

The present invention overcomes the disadvantages discussed above by providing a method for scaling, sizing and fitting eyeglasses or other personal products used in proximity to an image of the iris of the human eye, by first taking an image of the user's face via an imaging device which may be located remotely from the merchant in a place which is convenient for the user. Second, the image is processed and scaled to provide an accurate measurement of the dimensions of the user's face, such as the interocular measurement, by using the fact that the human iris for almost all people over the age of two is remarkably constant in diameter. Therefore, the iris acts like a built-in ruler when an image including the iris is taken. Therefore, given that the diameter of the iris is a constant, with this information, an image of a human face, for example, will contain a number of pixels

within the diameter of the iris in the image. Therefore, a ratio of millimeters to pixels can be utilized to determine any distance on the image. Thus, the method of the present invention allows an accurately sized, and scaled, pair of glasses to be purchased without physically visiting a specialist or a merchant. Furthermore, the method of the present invention allows a virtual "try-on" by the consumer of personal products such as eyeglasses or cosmetics over a computer network wherein accurately scaled products can be viewed on or near the image of the user. Additionally, goods such as furniture or clothing can also be sized to the user. Further, any image or picture from any source which includes an iris can be sized and scaled using this method.

4. Brief Description of the Drawings

Fig. 1 is a cross sectional view of the human eye.

Fig. 2 is a perspective view of the human eye.

Fig. 3 shows a cross sectional view in relation to a front view of an eye in place.

Fig. 4 is a perspective view of an eye.

Fig. 5 is a front view of human eyes showing the interocular measurement.

Fig. 5a is a front view of a human face with eyeglasses fitted properly.

Fig. 6 is a front view of a human face showing various areas which can be measured.

Fig. 7 is a perspective view of a screen displaying a user performing a virtual try-on of eyewear.

Fig. 8 is a diagram of a typical communications network which may be used in conjunction with the present invention.

Fig. 9 is a flow chart of an algorithm used in the present invention.

5. Best Mode for Carrying Out the Invention

As seen in Figs. 1 and 2, the human eye is comprised of a variety of parts, including an iris. Fig. 3 shows that the iris is the darker part that is visible when

looking into someone's eye; the iris is surrounded by the white sclera, and the iris has a pupil at its center.

The present invention uses the fact that the diameter **20** of the human iris **10**, as seen in Fig. 4, is effectively constant within the population of humans over age two. Any individual variations from this constant diameter **20** of the iris **10** are typically small, and do not affect the functioning of the present invention adversely.

In operation, it is preferable to have an imaging system linked to a communications network as shown in Fig. 8 which takes an initial video or still image **25** of the user (see Fig. 6) via an imaging device **40** which may be a digital camera or a photographic camera The video camera **40** provides a work station **42** which includes a display screen. This initial image **25** is sent via the network to a headquarters database **44** and/or imaging workstation for processing. This image **25** is preferably in digital form at the time the image is captured (such as via a digital camera) but can also be converted to a digital image through known techniques, such as via scanning.

The initial image **25** contains an image of the iris **10**, and the image (or an additional image) also contains an image of an object aside from the iris, for example someone's face or an inanimate object. According to a best mode embodiment for carrying out the invention, after the image or images are obtained, a size ratio is estimated between at least one dimension of the object and the iris, by analyzing the image or images. Then, the at least one dimension of the object is approximated based upon the size ratio and the invariant iris diameter of human beings. The size ratio is preferably determined using an algorithm (see Fig. 9) in a program which counts the number of pixels **100** (see Fig.6) in the known diameter **20** of the iris **10** initial image **25**. With this information, a measuring ratio of millimeters to pixels is created in the algorithm, so as to determine any distance on the image. For example, referring to Fig. 9, if the diameter **20** is 12.81 mm, then there are ten pixels in the 12.81 mm diameter **20** in the image **25**, and each pixel equals 1.28 millimeters (the number 12.81 is used here merely as an example, and the actual number can be determined by mathematically analyzing precise

measurements of different people). In this way, the iris acts as a built-in reference ruler, i.e., from a front view it is a circle of a constant diameter (even from a side view the iris will appear to be an ellipse having a major axis equal to the constant diameter). For example, in Fig. 6, if the width of a chair back **38** is virtually cut and pasted into the image and is next measured and designed to be a certain number of pixels in width, for example, then an actual physical chair can be ordered to the required dimensions of the user by using this virtual try-on method which uses the known diameter **20** of the iris **10** as a reference measurement in the image **25**.

The same process may be used for fitting and scaling eyewear such as eyeglasses or sunglasses as shown in Figs. 5, 5a, 6 and 7. Fig. 5 shows the interocular measurement **30** which varies from person to person. Referring to Fig. 6, it is easily seen, as discussed above, that the iris **10** has a constant diameter **20**. Knowing this constant, as described above in detail, allows an initial image **25** (see Fig. 6) to be taken and processed, thus enabling a virtual "try-on" of eyeglasses **33** as shown in Fig. 5a, which may be displayed on a display screen as shown in Fig. 7 over the network as shown in Fig. 8. It is also apparent from Figs. 5a and 6 that other measurements, aside from interocular distance **30**, may be calculated using the present method, including mouth size **31**, cheek bones **32a** and **32b**, eyebrows **33a** and **33b**, and eyelashes **34a** and **34b**.

In this manner, other personal products may also be virtually tried on with accurate scaling, representation, and measurement such as makeup, lipstick, rings, wigs, and other personal products. More than one image can be used in this process. For example, it may be desirable to obtain an image of a person's head including an iris, and to obtain a separate image of another body part such as a foot, using either the same imaging device or a different imaging device that is at a different elevation but at the same distance from the object (preferably the imaging devices have the same focal lengths). Moreover, the concept of invariant iris diameter may also be correct for other animal species, and therefore the present invention can be used for any species having invariant iris diameter, for example to facilitate virtual try-on of pet products.

It is also significant that, using the present invention, any image or picture from any source can be properly scaled using the iris reference measurement. This means that scaling can be performed at any location.

While in the foregoing specification, several embodiments of the invention have been set forth for purposes of making a complete disclosure, it will be apparent to those skilled in the art that numerous changes may be made without departing from the spirit and principles of the invention.